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ABSTRACT

This longitudinal study explored the effects of early language stimulation upon norms of the language development of three infants. When the infants were 4-5 months old, a long-term program of intensified early language stimulation was implemented by weekly home tutoring sessions with the parents. The tutor stimulation program consisted of an adult-guided model of environmentally specific language activity framed in interpersonally sensitive modes of adult-child interactions. These modes consisted of five types of parent-child activities: routines of daily caregiving, sociodramatic play and sensory motor play, object exploration and manipulative play, periodic trips inside and outside the home, and looking at clear simple pictures in books. In all forms of activity the stress was on alternating adult modeling with infant initative or responsive behavior, encouraged by adult responsiveness or suggestion. Two measurements were used: (1) periodic tests of cognitive development (including a language quotient), and (2) a system of daily record keeping by parents which included a developmental study of initial vocalization, comprehension, imitations and productions of words, phrases or sentences. Results indicate that the mean levels and rates of language development for the three infants greatly surpassed norms of development, the language acquisition indices developed in the same sequence for each child, and the stimulation program may be facilitating the development of other abilities in the child. (GO)

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The Influence of Early Stimulation on Language Development

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What is the role of experience in first language acquisition? Recent emphasis in psycholinguistics has viewed the language environment as a resource from which an innately programmed mechanism (LAD) draws to generate intelligible language communication rules (McNeil, 1970). Historically, the environment was often seen as both the shaper and source of language learning through the association of environmental events with response processes. Without attempting to settle this question here, the existence of a biological mechanism for acquiring language rules would not seem to preclude considerable variation in both the timing of acquisition and the specific set of rules acquired, as indeed the literature on social class, cultural and individual differences shows. But while we already know much about the upper age limits of acquisition--developmental delay can reach the point of no return (Lenneberg, 1967)--less is known about the lower age limits. This exploratory study is an attempt to learn more about the effects of early language stimulation upon norms of development and incidentally shed more light on its influence on the forms of development.

Design

Three first born infants of normal birth, two boys and one girl, from suburban, middle class Canadian homes were selected on a volunteer basis for study through a local pediatrician. Mean midparent education was 15.6 years of schooling. Selection criteria were designed to optimize responsiveness of both parents and children to the program. A systematic longterm program of intensified, early language stimulation designed by the principal investigator was mediated through guiding the parents in weekly home tutoring sessions, during the first three months by the first investigator and thereafter every two to four weeks by the coinvestigator. Stimulation began at four to five

months, well in advance of the earliest reported 8 months age for language acquisition (McCarthy, 1954), and has continued in some form to the infants' present mean age of 17 months.

Language Program

The stimulation program consists of an adult guided model of environmentally specific language activity, framed in interpersonally sensitive modes of adult-child interaction. The primary initial focus was on frequent labeling of concrete objects and easily visible actions common to the infants' daily experience. Stressed terms were presented largely in simplified but varied sentence and phrase forms and intonational patterns natural to the speaker. All terms were applied to a range of object and action examples to foster cognitive language rule acquisition over rote learning. As development has progressed, a more differentiated emphasis on relations and descriptives represented by other parts of speech, expansion of sentence forms, and a broader array of cognitive concepts has been increasingly made. No special attention has been devoted to syntactical forms, such as subject-predicate-object relations. A suggested lexicon of words, objects and actions was furnished to each family and later selected picture books were provided.

Language stimulation has been embedded in five types of parent-child interaction. (1) First, the routines of daily caregiving in feeding, washing, changing and dressing the infants. Such routines provide a convenient minimum base for language stimulation because of the regularity and frequency of a familiar set of personally relevant items for language focus. (2) Second, the sociodramatic play of "peek-a-boo", "this little pig" and similar culturally normative maternal-child interactions, which embed language in repetitive but cognitively interesting sensory motor play. (3) Third,

object exploration and manipulative play with selected sets of miniature objects and replicas, which integrates language and cognitive learning through interactive play in the sensory motor medium natural to the infant. (4) Fourth, periodic trips led by the parent around the kitchen and other familar home settings, to explore and label such objects of perceptually appealing form and size, as clocks, lights, radios and chairs. Excursions outside the home are an extension of the same practice. (5) Finally, looking at clear and simple pictures in books or cut-out magazine pictures pasted on cards constituted an increasingly important form of language medicted cognitive stimulation, from about 6 to 8 months on. In all forms of activity, the stress was on alternating adult modeling with infant initiative or responsiveness, encouraged by adult responsiveness or suggestion. Parents were encouraged to frame verbal suggestions mainly to elicit comprehension (indicated by discriminative pointing) even after spontaneous imitation and speech were well established to enable the child to respond to a given label in terms of a limited set of visible objects, rather than to try to recall one of an infinite number of labels (production) or simply be tested on language pronunciation (imitation).

Measurement

Two forms of measurement were employed. A standardized test, the Griffiths Scales of Mental Development (1954, 1970), which provides a general quotient (GQ) and a profile of specific developmental competencies, including a language quotient, was administered at a mean of 4, 10, 13½ and 17 months of age, and another measure of receptive and productive language development, the Reel Scale (1971) was administered at a mean of 16 months. The first

(pretest) and the third and fourth Griffiths testings were administed blind by different testers. The second form of measurement was a system of daily record keeping by parents of the number and duration of stimulation sessions by type of activity conducted daily and a record of the infant's language development of initial vocalization, comprehensions, imitations, and productions of words, phrases and sentences. Parents were provided with record forms, which in the case of language development, provided space for recording the first occasion of using new units for all categories and the circumstances under which observed. We repeatedly cautioned the paretns to use the following criteria for comprehension and production.

Comprehension. A word was listed if the infant gave observable behavioral evidence of understanding in the absence of any cues from the parents.

Production. A word was listed as spontaneous speech only if it was used in an appropriate context and could not have been an immediate imitation.

The criteria for imitation were left to the individual praents, who recorded both parents word utterance and an approximation of the sounds made by the infant in his attempt to imitate.

Given the small sample and lack of experimental controls normative comparison is the chief method of analysis.

Developmental Outcomes

Language Quotients. Both in mean scores and individually, the three children show a rise in the Griffiths language subscale from an average level at 4 to 5 months to a superior level of 125 or more at about 17 months (Figure 1). Individually, however, one child rose between each test, while a sharp initial rise of the two others was followed by moderate decline and a further slight rise.

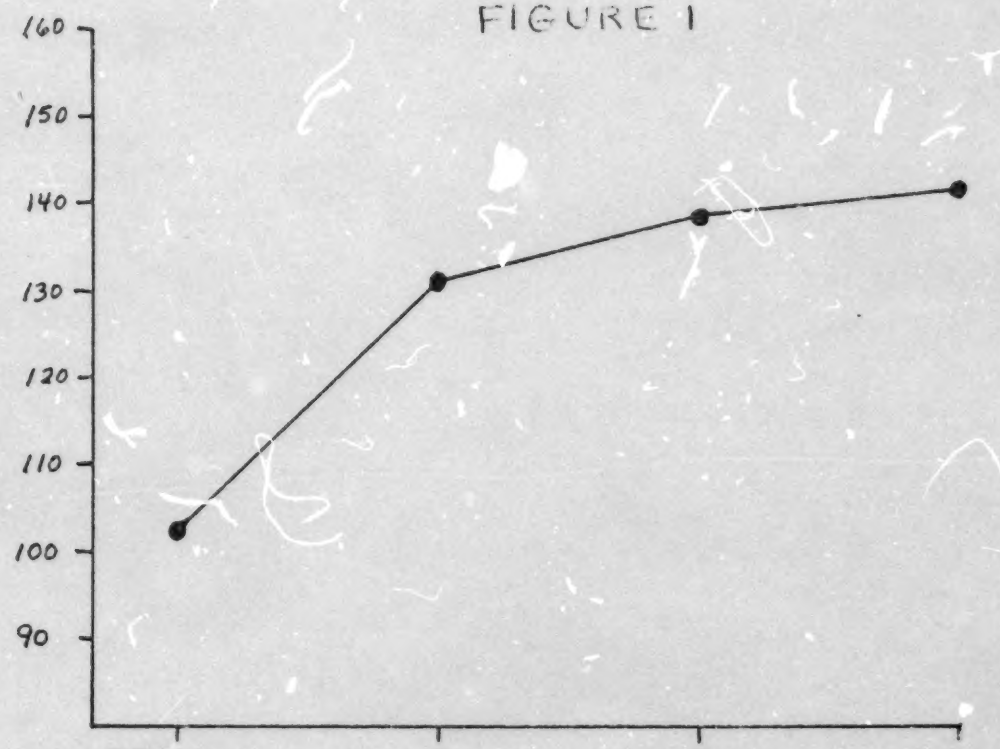
Figure 1

Relations of Language to Profile of Abilities. At pretesting Griffiths mean subscale scores are close to a quotient of 100 for all abilities except for a slightly lower level for the locomotor subscale. On all subsequent tests, mean language scores are consistently close to 20 points higher than mean scores for any of the other scales. Mean scores on the Reel Language Scales at 14.8 months are similarly inflated. After some fluctuation, the other mean subscale scores and the scale GQ average are presently both fairly well clustered and elevated from 7 to 20 points above pretest levels.

Figure 2

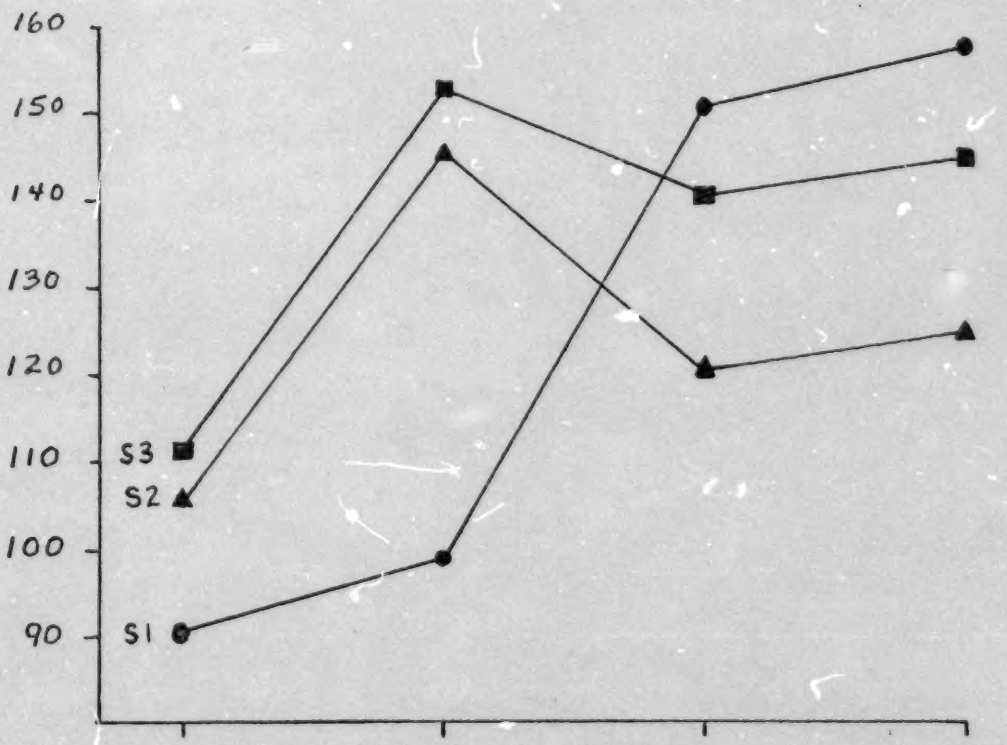
Language Acquisition Curves. The mean cumulative acquisition curves displayed in Figure 3 show first an increase in comprehension of single words, then in imitation and production of single words, sentence comprehension, and finally in two-word phrases. The shape of the curves is similar for all of these indices: starting slowly, rising moderately, and then rising at rates

FIGURE 1



MEAN GRIFFITHS LANGUAGE SUBSCALE SCORES

N = 3

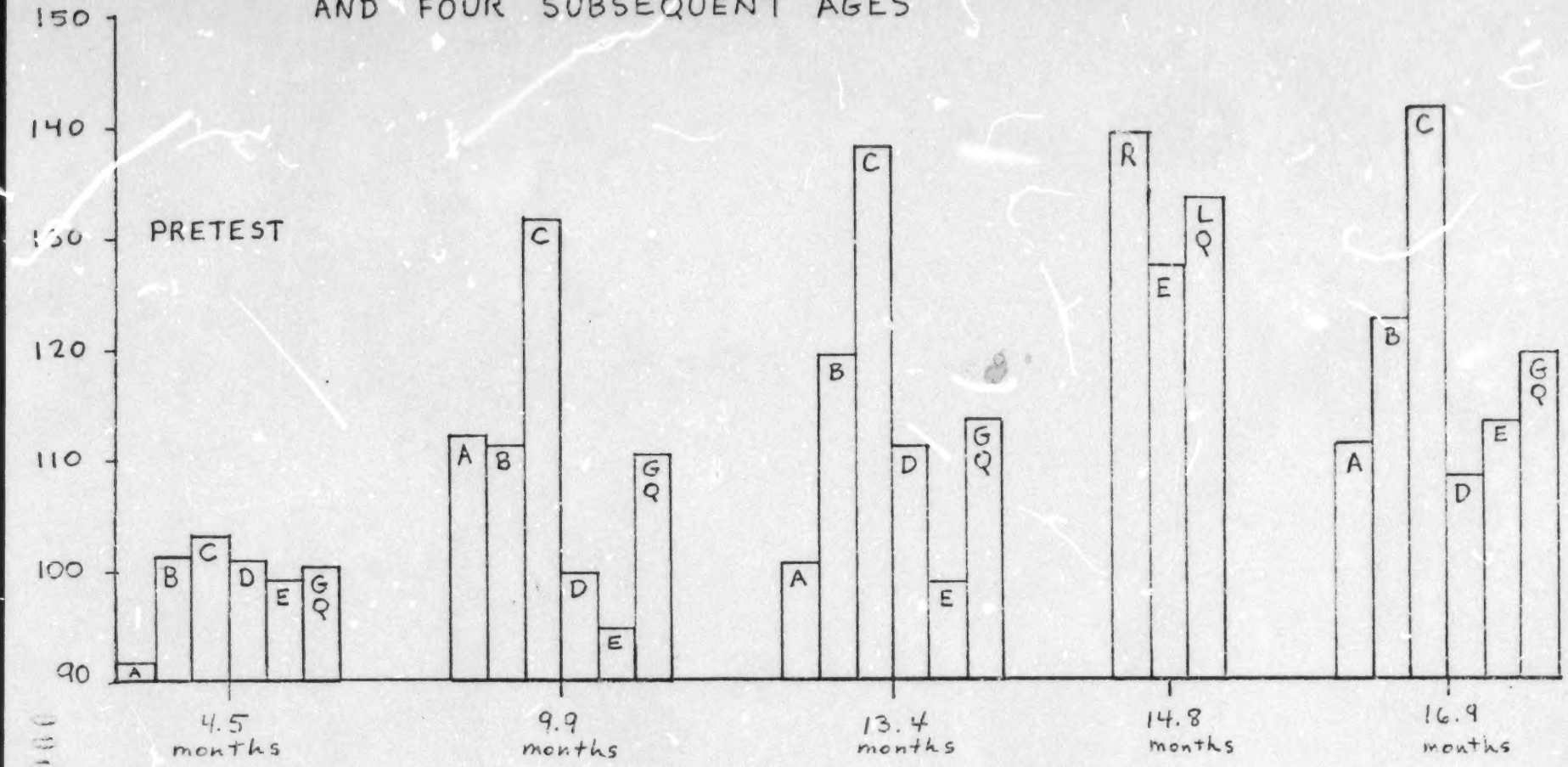


INDIVIDUAL GRIFFITHS LANGUAGE SUBSCALE SCORES

C.A. (months)	TEST 1	2	3	4
S1	4.0	9.3	12.3	16.2
S2	5.0	10.5	13.5	17.3
S3	4.5	9.8	13.5	16.8

FIGURE 2

MEAN MENTAL TEST SCORES AT PRETESTING AND FOUR SUBSEQUENT AGES



Griffiths: A - Locomotor
B - Personal-Social
C - Hearing & Speech
D - Eye & Hand Coordination
E - Performance
GQ - General Intelligence Quotient

REEL: R - Receptive Language
E - Expressive Language
LQ - Language Quotient

N = 3 (2 male, 1 female)

so rapid that accurate recording of the index was very difficult for the parents and had to be abandoned.

Figure 3

Separate phrase-sentence acquisition curves are displayed for two of the three subjects in Figure 4. One of these Ss began to produce five word sentences as early as 16 months and the other, four word constructions by 17 months. The third child, not graphed here, began two word combinations at thirteen months, and used five new two word phrases in the past month, at 16 months.

Figure 4

Vocabulary learning rates for the three infants indicate similar rates for two Ss of seven or less words per month between 8 and 11 months, at which point both jump rapidly to about 15 or more words per month by 13 months. The third infant initially rose more rapidly to a rate of 11 words per month by age 9 months, then fell back sharply in one month to less than 5 per month until 15 months. He is now beginning to resume a more rapid rate of vocabulary acquisition and phrase development.

Figure 5

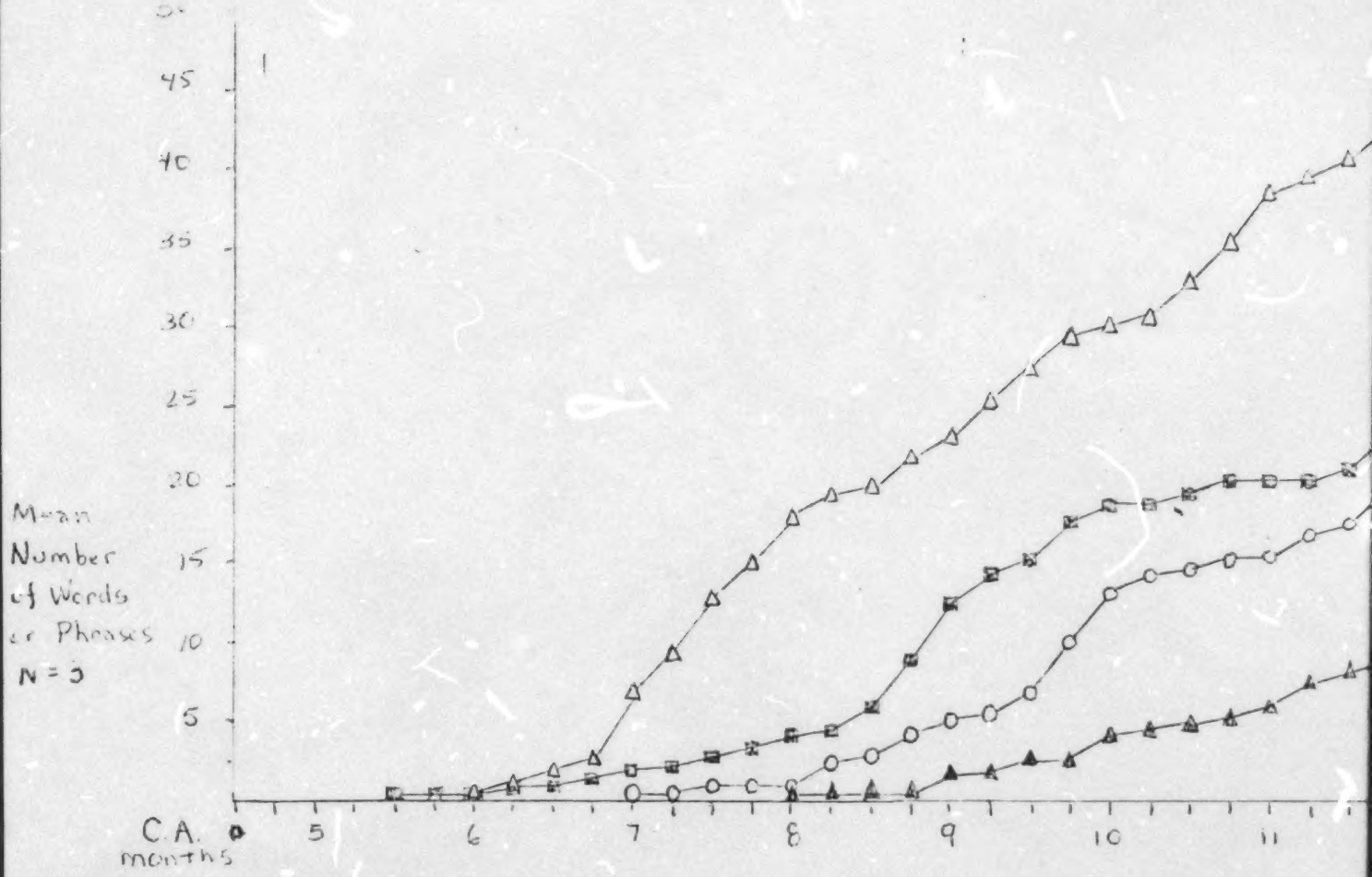
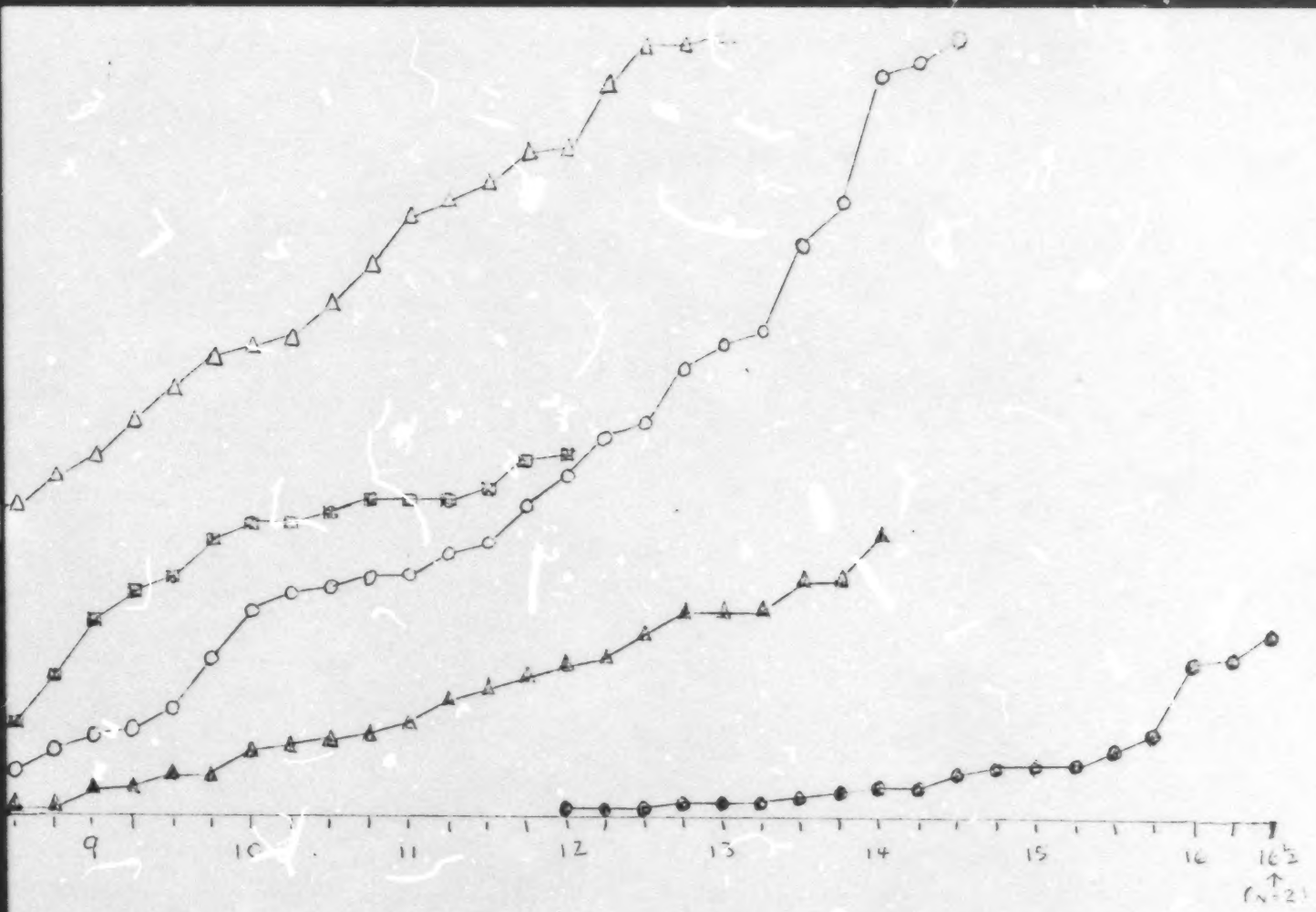


Figure 3: Mean Cumulative Language Acquisition



ty recording after 12½ months)

d difficulty after 12 months)

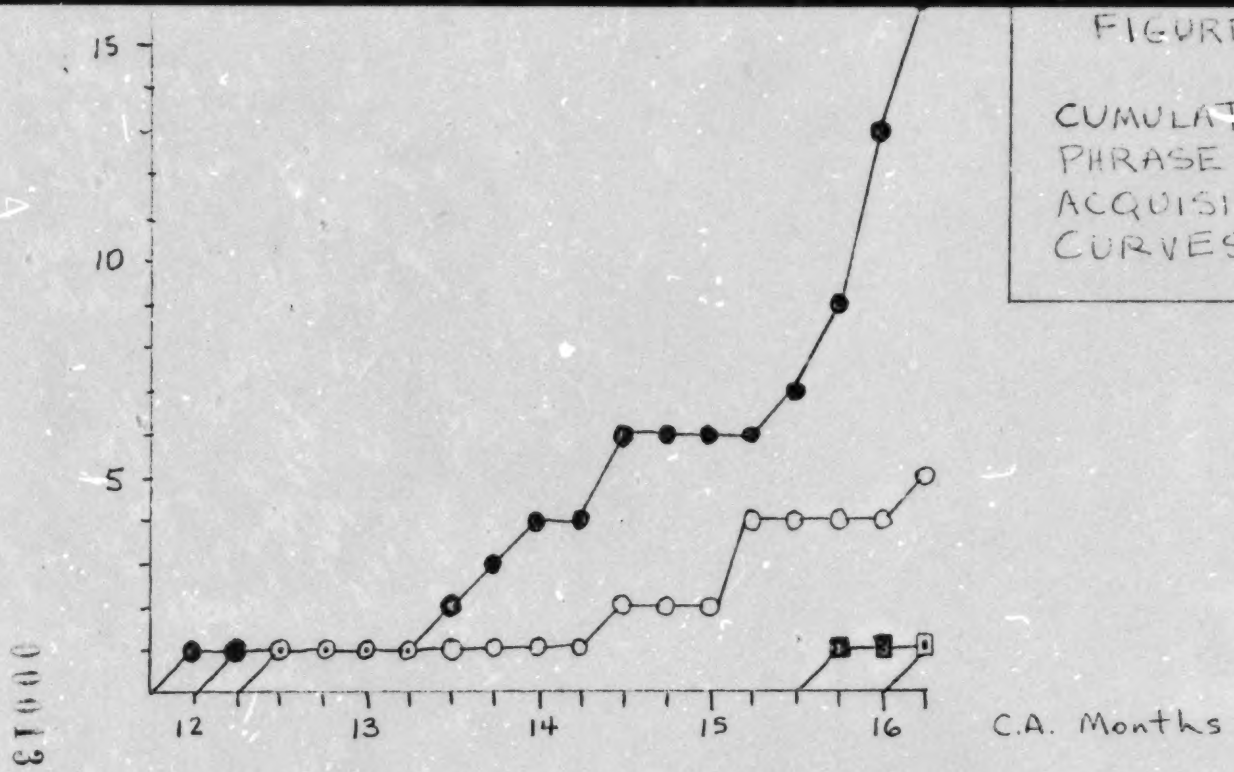
difficulty after 50 word level reached)

iculty in recording and verifying understanding after 13 months)

Mean Cumulative Language Acquisition Curves

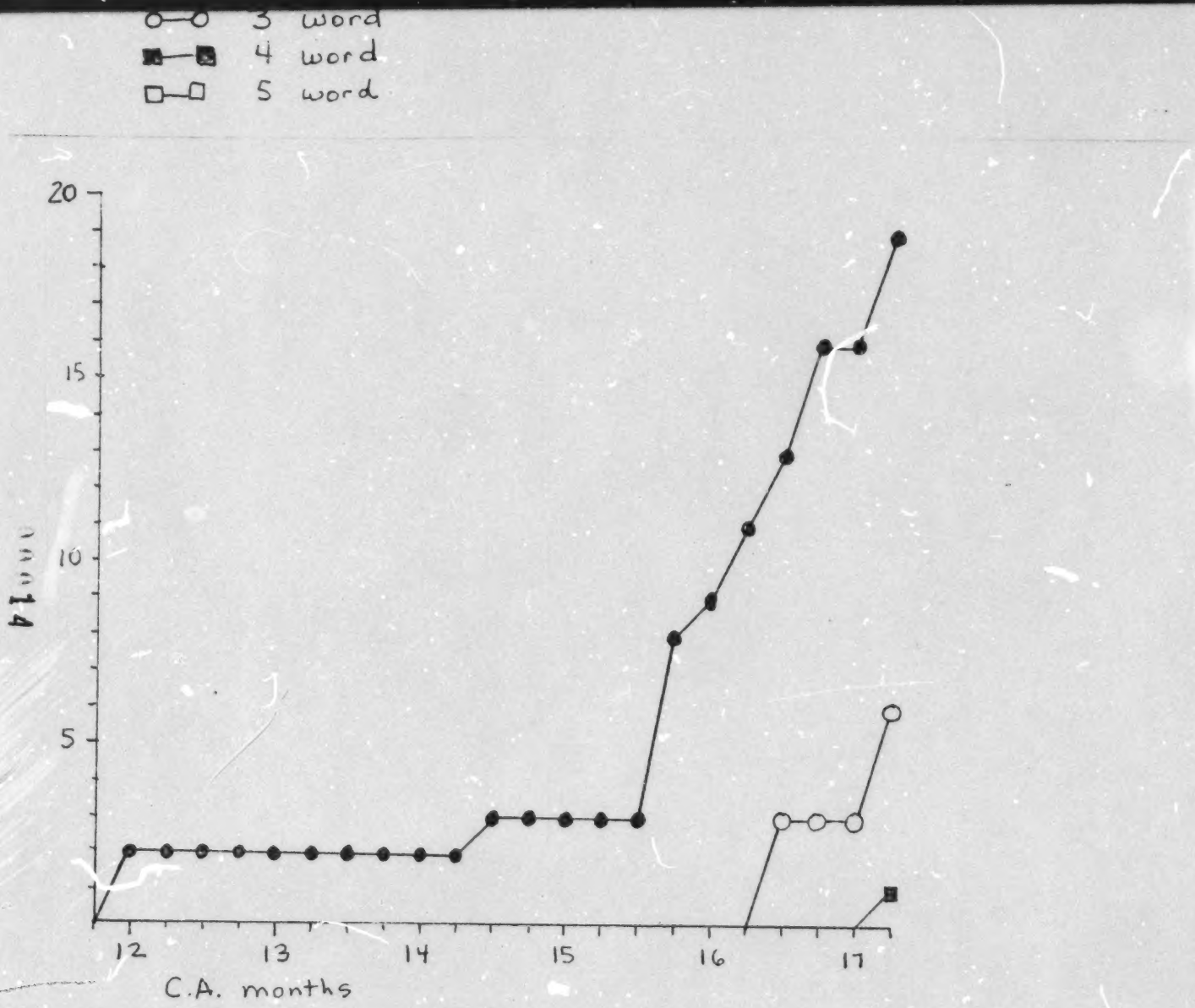
FIGURE 4

CUMULATIVE PHRASE ACQUISITION CURVES



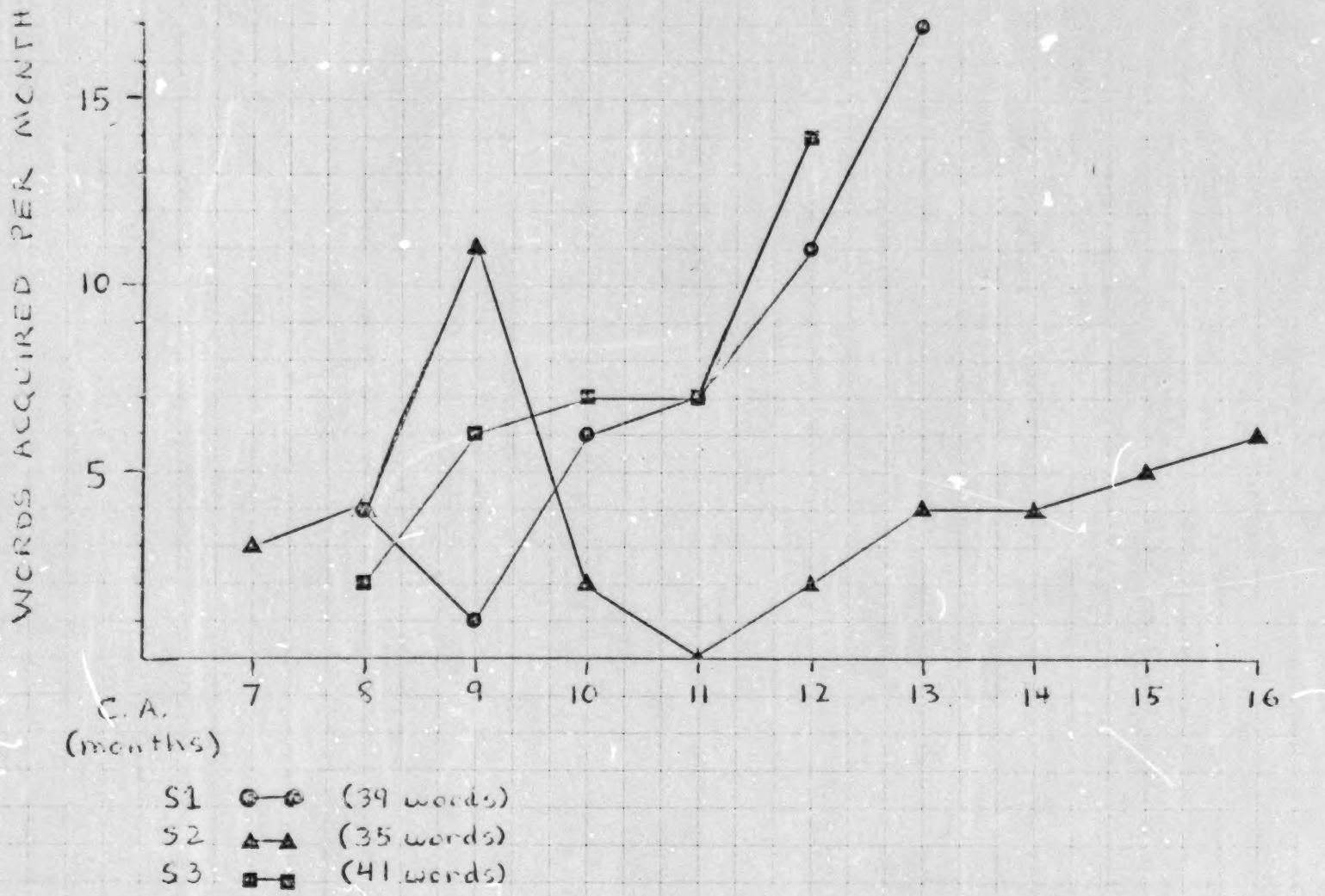
Subject I Number of Spontaneous Phrases with Different Constructions

- 2 word
- 3 word
- 4 word
- 5 word



Subject 3 Number of Spontaneous Phrases with Different Constructions

2 word
3 word
4 word



INDIVIDUAL WORD ACQUISITION RATES
IN EARLY VOCABULARY LEARNING
FIGURE 5

Language Stimulation and Developmental Outcomes

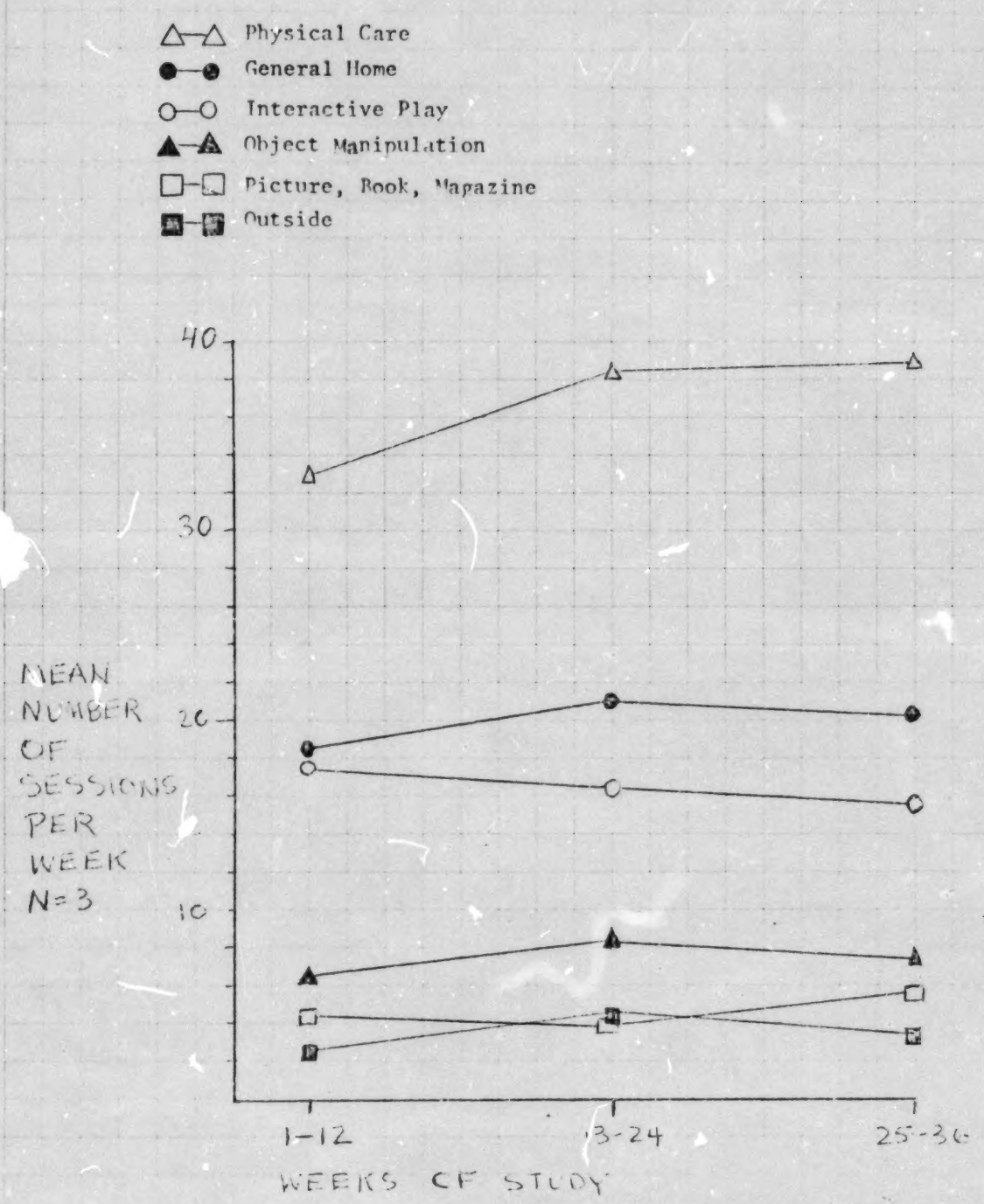
Language Stimulation Rates. Mean weekly rates of stimulation are displayed in 12 week blocks in Figure 6 to show main trends. Mean rates were fairly consistent for all activities over the course of the 9 month period recorded, but there is a clear hierarchy of frequency by type of activity, ranging from the high in basic physical care routines to the infrequent experiences outside the home.

Figure 6

Relations Between Program Vocabulary and Infants Speech Vocabulary. The mean number and percentage of words in the early speech vocabularies of the infants, which are represented in the prepared vocabulary lists, were identical for the original program list and the two lists later compiled by the mothers (Table 1). As seen in Table 1, the figures for words represented on all lists are only slightly lower, reflecting the fact that the mothers' lists drew heavily from the basic list. Over two thirds (68.3 per cent) of the infant's initial 20-word vocabulary is found on at least one of the curriculum lists.

Based on many home visits made during the period in which the first twenty words were recorded, the co-investigator reports that the remaining 31.7 per cent of these initial vocabulary words were used frequently in the home, but were not listed by the mothers. Some of these words describe objects which were labelled by the mother in response to an interest in the object on the part of the infant (examples: button, door knob, glasses). By twelve months of

Figure 6: Frequency of Types of Labelling Activity



age, all three infants developed a standard way of asking "what is that?" (S_1: what?, S_2: pointing; S_3: wha'sa'?) to obtain a label for an interesting object.

Table 1

Vocabulary Profiles. As seen from Table 2, the overwhelming proportion (77%) of the first 35 words for the three infants were nouns, and a large proportion of these represented small, manipulable objects as Nelson (1973) also reports. The next major category was action terms, some of which were actually verbs and others of which were prepositions like "off" or "down" that functioned as verbs. A few personal-social expressions are found for each child, but no more than three modifiers. In the categories of both animals and people, the majority of the words represent specific pets or persons rather than generic types.

Table 2

Relations Between Comprehension, Imitation and Production. Fifty per cent of the first 20 words were listed by the mothers as having been comprehended before they were produced in free speech. Forty-three per cent of the first 20 words were listed as having been imitated at least once before used in free speech. A mean of at least 28 per cent (28.3) of the first 20 words were first comprehended, then imitated and later appeared in spontaneous speech.

Table 3

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Table 1

Relations Between Program Vocabulary and Infants' Speech Vocabulary (First 20 Words)

	Infants' Speech Vocabulary Represented on:			
	Basic Curriculum Lists	Maternal[a] Curriculum Lists	All Curriculum Lists	Any Curriculum List
Mean Number	11	11	8.3	13.7
Mean Percentage	55	55	41.7	68.3

[a]Two lists compiled by each mother consisting of words actually focussed on

Table 2

S_1 35 Words (13 mos.), 50 words (14 mos.)

Nouns										
Food	Animals		People		Parts of Body	Objects		Action	Personal-Social	Modifiers
	General	Specific	General	Specific		Small	Large			
Banana Hum (food) Applesauce				Mama Baba (grandma)		Flower Button Shoe Ball Doll Keys Watch Bear Phone Cup	Light Owl Door Chair High-chair	Down Bath Upstairs Boom Haita (out) Walk	Hi Yes Hello No Bye-bye Wow	What Yellow The
Orange Meat Cookie Juice			Man Boy	Bonnie Zaida (grand-father)				Open Off Splash		More
						Coat Botchie (diaper)				
S_2 35 words (16½ mos.)										
Toast Cheese Cookie Yogurt	Dog Cat	Sherry Mandy	Daddy Ma Baby	Daddy Ma Baby	Eye Nose	Ball Watch Glasses Card Car (toy) Boy (toy) Book Cup Girl (pic. or toy) Toy	Light Door Book-shelf Bed	Up Bath Done Out	Hiya Good Bye No	

Table 2 (Cont'd)

S_3 35 Words (12 mos.), 50 words (13½ mos.)

Nouns										
Food	Animals		People		Parts of Body	Objects		Action	Personal-Social	Modifiers
	General	Specific	General	Specific		Small	Large			
Juice	Fish		Baby	Chuck		Bib	Window	Up	Ta (thank-you)	One
Banana	Cat			Mama		Dog			No	
Apple				Mike		Duck	House	See-saw	Hiya	
Cookie				Yola		Shoe	Smoke	Knock-knock	Bad	
Bread						Button				
Toast						Flower				
						Door knob				
						Tick-Tock				
						Powder				
						Pail				
						Lotion				
						Truck				
						Box				
						Water				
						Book				
						Radio				
						Guitar				
						Owl				
						Bug				
						Purse				
						Doll				
						Car				
						Block				
						Brush				
						Mitts				
						Boo-boo				

Total Number/Percent[a] of First 35 Words in Each Category

Nouns 77								Action	Personal-Social	Modifiers
Food	Animals 6		People 9		Parts of Body	Objects 50				
						Small	Large			
10	4	2	1	8	2	40	10	11	13	4

[a]Number is virtually identical with percentage because total words for 3 Ss is 105.

Table 3

Relation Between Comprehension, Imitation and Production

Words Recorded as Comprehended and/or Imitated Before Use Observed in Free Speech (First 20 Words)

	Comprehended	Imitated	Comprehended and Imitated
Mean Number	10	8.7	5.7
Mean Percentage	50	43.3	28.3
Mean Time Lag Before Production (Weeks)	4.6	2.7	C 5.3 I 2.5

Discussion

Mean levels and rates of language acquisition for the three infants greatly surpass norms for development, measured against either standardized test norms or specific indices of vocabulary and sentence acquisition. Starting from an essentially 100 quotient level at 4.5 months when the program began, the mean language quotient at 16.9 months was slightly over 140. The mean age for acquiring the first 10 and 50 words uttered was just under 10 and 14.5 months, respectively, in each case 5 months in advance of the 15.1 and 19.6 months means for Nelson's (1973) similar middle class sample. Two word phrase constructions appeared at a mean of 12 months compared to greater than 20 months for the Bayley (1969), Griffiths (1954) and Reel (1971) scales. Acquisition rates followed the usual accelerating curve for two of the three infants, but began and accelerated earlier.

Though starting at the same mean level, mean language scale scores surpass by 20 or more points mean scores for all other Griffiths scale abilities from age 9 through 17 months. The mean Griffiths GQ rise of nearly 20 points, which is reflected in substantial gains in all other subscales, suggests several possibilities, among them that the stimulation program may be facilitating the development of other abilities; that language is mediating the development of other competencies; or that the children are (normatively) developing according to expected middle class norms around 120 IQ.

Language acquisition indices for each child follow the same order: comprehension, imitation and production of single, words, sentence comprehension, and then two word phrase production. Phonological indices showed a marked rise, shortly after program onset, and in two unit (cc, cv, vv) and in complex sound strings (e.g., bli, uni, mbuba) which were concurrent with a dramatic rise in word comprehension. This pattern may reflect a logical

order with which language is acquired. Phonological expansion is associated with word comprehension and each word must first be understood before the child can reproduce it meaningfully in speech. Moreover, at least in the early stages of acquisition, he/she makes his first utterance trials in immediate imitation of modeling by others. Later, he/she begins to comprehend phrases, together with the rules for making them which enables him to generate phrases of his/her own.

It would appear that a number of the outcomes in language development are traceable to specific features of the program, including parent styles differences which contributed to differences in patterns of acquisition. At least two thirds of the infants' first 20 words were apparently first modeled--that is uttered while pointing to the object--by the parent in the presence of the infants and there is observational evidence that the other third were similarly modeled, usually in response to the child's interest in an object which the parents then labeled. The concrete, sensory motor orientation of infancy is reflected in the high proportion of the first 20 words that were nouns (77%), and small and/or manipulable objects (40%) at that--though it also true that parents were advised to and did center attention on these categories.

Differences in style were most marked between the parents of the two infants (S_1 and S_3) whose acquisition curves followed a constant acceleration to their present high levels and the third infant (S_2), whose curve was initially the most accelerated, then declined precipitously and leveled off from 10 to 12 months. The former two mothers were generally flexible, interactive and playful in their approach, often incorporating in the curriculum words in response to the child's interest. The latter parents (both mother and father), in contrast, were generally more directive, inflexible and mechanistic in approach. Only

one of the 20 first words involved labeling an object in response to their infant's interest and they too often labeled the same object 5 to 10 times in rapid succession without regard to the child's attention. This directive parental style may have contributed to the delay in S_2's walking and self-feeding to 16 months, about 4 months later than the normative patterns of S_1 and S_3. Repeated efforts by the authors to encourage flexibility in parent-infant interaction have succeeded to some degree with all parents, and we believe that S_2's recent rise in language acquisition is due at least partially to a modification of parental style.

The apparent success of this approach to language stimulation may be attributed in part to its multidimensional orientation, in which several major elements and relations of language, cognition and interpersonal modes are integrated into a holistic, developmental framework. The early and longitudinal approach of this study is quite in contrast to the historical shortterm training study of Strayer (1930) on word stimulation of 18 month old identical twins, an example too long typical of the field. Further monitoring and guidance of the parents in aiding them to foster the development of their now precocious infants is planned, as well as larger scale controlled studies on additional infants to validate the findings of this pilot study.

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